WHAT'S T ATT

Indigo has gone it alone with its ElectroInk for digital presses, while all the other major manufacturers use toner. What difference does it make and who is right? asks CARYL HOLLAND.

Although the manufacturers would like us to believe otherwise, these days conventional offset printing inks are pretty much alike, at least in terms of ingredients, the print quality being much more affected by such things as the repro, press operator skills, and so on.

Is this also the case when it comes to digital presses, that is the engines sold by Indigo and Xeikon (plus its Agfa, Xerox, IBM and Nilpeter OEMs)? Technically, the answer is no. In fact, Indigo has recently been promoting the differences following the launch of its third generation of toner or digital ink, as it likes it to be described, because it uses a wet rather than a dry process as with the Xeikon engine.

In other words, although both engines are based on electrophotography with a charged photoconductive surface being used to attract toner particles with an opposite charge, Indigo's ElectroInk consists of a paste made up of pigmented polymer particles one or two microns in size and a conductive oil. These are mixed to the correct density, temperature and electrical conductivity by the digital press to form a liquid suspension of pigmented particles.

The other main difference with the Indigo technology is that having created the toner image, it is transferred to a blanket which is heated to drive off the liquid before being bonded to the printing substrate.

The Xeikon engine, on the other hand, uses dry microtoners, the system having been developed by combining the LED and non-contact fusing toner technology developed for Agfa's P400 printer and the pigments used in the Agfaproof proofing system. In simple terms, the LED creates a charged image on a photoconductive drum in each of the print units. This attracts the microtoner to the imaged areas which are then transferred directly on to the paper.

The microtoners which are between five and seven microns in size, are controlled through magnetism having been mixed with what is called the developer. This is a carrier that consists of ferrous particles to a maximum concentration of about 4%, to which the microtoners cling by static attraction.

The microtoners and developer are manufactured at Agfa's recently completed multi-million dollar plant in Heultje, Belgium. The company has an exclusive supply arrangement with Xeikon, at least for the present: it is understood that there are three other toner manufacturers carrying out field trials.

However, according to Richard Barham, sales and marketing manager for Chromapress digital printing at Agfa UK, they have not yet been able to achieve Agfa's levels of cost/performance, quality and usage: the advantages of Agfa's microtoners are said to include their fine particle size, the evenness of the image gloss after fusing and the expanded colour gamut. The developer is also claimed to offer the longest life of any comparable product available on the market.

As Steven Schamphelaere of Xeikon explains: "Although we cannot say we are not looking at other suppliers, there is only one at present, that is Agfa. They have invested a considerable amount over the last four or more years in developing the toner for the Xeikon engine so it is not something which other manufacturers could achieve over a short period of time."

Who the other manufacturers are is not known although it is interesting to note that Xerox uses a similar principle with its DocuColor 40 (and the Scitex Spontane), the engine and toners for which are supplied by Fuji-Xerox. Nor is Indigo the only company with liquid toner technology. It is also used, for example, by wide format electrostatic printers supplied by companies such as Xerox, ColorgrafX and 3M.

On the other hand, both Agfa and Indigo are continuing to develop improved products. Mr Schamphelaere reports that the Xeikon machine has room for a fifth print station and is working with Agfa on applications for it such as a white-on product as well as a transparent toner which would allow a synthetic varnish to be applied.

"We have done tests using a transparent toner and technically it is feasible. However, economically, it is more efficient to do it off-line although we are still keeping the option open."

In fact, both companies say that the toners can make an enormous difference. Mike Englander, vice president of marketing for Indigo Europe, goes as far as to say that he regards Indigo as more of an ink manufacturer than a digital press manufacturer. "If Benny Landa had been able to find someone to build the machines and everything else I think he would have been delighted. We are actually an ink company and ElectroInk is very much a core patented technology. We see much of the future development of the technology coming through the digital ink side."

When it comes to

Changing the toner in a Xeikon machine.

Mike Englander.

IE RACTION?

the pros and cons of the two technologies, the Xeikon protagonists say that dry toners are more stable, reliable and controllable. They are environmentally safer, the toners contain no toxins and there is no hazardous waste. They also have a proven record with more experience in how to control the characteristics, pointing out that the old photocopiers used wet toners but everyone moved away from them.

In reply, Mr Englander says: "For the first 15 years of its life, Indigo researched, developed and licensed technology for other manufacturers. In fact, whatever photocopier you use, it will probably have at least three to four Indigo patents, especially if it is a high speed model.

"From this work, we saw the limitations of xerography if we wanted to go to higher process speeds. The trouble is the faster you go with xerography the larger the size of toner particles that are necessary so as to be able to control them; with anything below five microns, the toner becomes volatile and cannot be controlled. With ElectroInk, which is in the one to two micron range, we can go faster if the market and we decide it is a good thing to do."

Mr Schamphelaere disagrees. "It has already been proven that the xerographic process is capable of working at very high speeds. Admittedly, the toner particles are larger but tests have shown that although the mechanics have to be controlled more closely there are no problems that cannot be overcome printing at higher speeds with smaller particles.

"Earlier in our strategy, we had the choice of going wider or faster. We decided to go wider and introduced the DCP/500 B2 size press which is capable of producing 6,000 A4 impressions an hour. However, for our simplex engine for the label and packaging market we have already announced that we will be doubling the speed. This is expected to be available in quarter four."

Richard Barham.

The other problem with xerography, according to Mr Englander, is that it will never be able to have the real look and feel of offset: "This is physically impossible because for a good quality threshold, the toner particle size needs to be about seven microns or less but with anything above three microns you will not get the translucency and uniformity of gloss.

Indigo's IndiChrome wide gamut printing system and enhanced personalisation tools for its E-Print 1000+ and Ominus digital offset colour presses (above) and toner cartidges (inset).

"With our ElectroInk Mark II, we could achieve some quite good gloss and take-up capabilities in certain areas but it tended to tail off. This was one of the reasons why we have introduced the Mark III inks.

"With xerography a powder toner is laid down and baked into the substrate so you get the same gloss independent of the type of paper and type of image. You therefore have something which is extremely flat and only in the areas where it coincides with the ideal gloss will you get something that approximates offset."

This may be true with xerography generally but, according to Mr Schamphelaere, not so far as the Xeikon system is concerned especially following the introduction of the second generation toners and developers and the Gem/(Agfa) OmniGloss secondary fusing stage.

"What the Gem does is to calender the toner surface after it has been fixed on to the paper. We apply heat and pressure and by modulating these we can modulate the glossiness of the overall image. It is a very efficient control."

Mr Barham at Agfa adds that the Xeikon system is also better at producing vignettes and highlights. "With the LED of the Xeikon system we can vary the density of the dot by attracting more or less particles of toner, as well as varying the size of the dot."

So much for the differences in technology but what about the practical realities? Unfortunately, we could not find a company in the UK which is running both systems and therefore could give a fair comparison. However, Indigo user Geof Lavey of CMYK in Wallington, Surrey, seems to sum up digital press owners' attitudes quite nicely.

When asked about comparing the results with offset, he replied: "From my background in print I would say it does come near to offset but does it matter? It has never been an issue with us.

"What we are doing is printing short-run colour. We have a bit of a reputation of producing very high quality work from Indigo. There are other companies that produce garbage but if their clients are happy with that then it is fine.

"I don't think Indigo should be happy with it as a company but you cannot tell a customer what to produce once they have bought one of your machines. Some people tend to regard the machine as a big quick photocopier, which it isn't. If you look after it, keep the environment clean and you have well trained highly committed operators, you can get first class results."

In other words, just as with conventional offset inks, it is outside factors which make the main difference, not the type of toner.

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Digital watch

all printing methods, digital printing is the fastest owing sector in the world. The number of digital machines talled is expected to grow by around 25% annually during e coming years. Today's technology for the few, will be morrow's business of many printing houses, copy shops d reprohouses. *Alexandra Jankovic* investigates the inting of the future.

The definition of digital printing remains somewhat of a mystery to many. One of the most common nitions is that as long as one is working n an original in digital form, the printing alled digital. The document itself may be ited with inkjet, dry-toner, thermal nsfer or even using conventional meth-

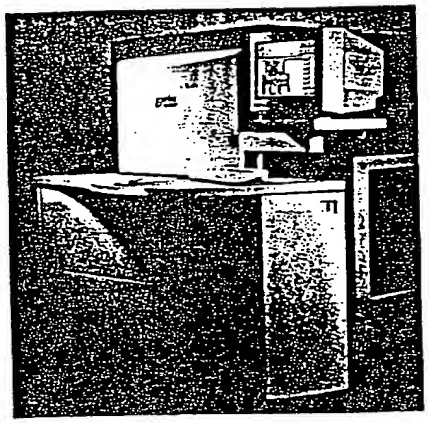
However, a simpler explanation is that ital printing involves the direct transfer digital original to printed matter, with original data transmitted directly from computer to the printer without the d for film or platemaking.

Digital printing technologies really took in 1990. At the same time, Xerox nched its first digital production pub-ing solution – Docutech. The manipula-n of data made possible by digital hnology triggered a revolution in the blishing process, empowering those in h the graphics arts industry and corpo-e print departments to produce docu-nts more effectively and efficiently.

The transition from traditional offset to ital print continues to accelerate. Xerox earch estimates that in Western Europe, % of all original print material is in digi-format, a figure set to double within the xt two years. It also estimates that in the 44% of existing print could be convert-to digital print. With this shift to digital, mpanies need to educate their customers out the possibilities of just-in-time, on-mand and short-run printing.

The ability to store data digitally means at material – be it the latest interest rate anges or backlist reprints of books – can printed out as and when the demand ctates. There is no need for warehouse orage and obsolescence is eliminated urrently, up to 50% of printed material ored in warehouses is thrown away).

When one considers the two factors termining the sale of printed material – ality and price – those hidden costs of oduction become significant as they will passed on to the customer in price. Digi-l printing also brings value added benefits ch as the ability to personalise documents ast look at all your junk, sorry, direct mail) rough the use of archived data and the insertion of colour as a means to aid communication.



Indigo's® E-Print® 1000+™.

Xerox provides a consultancy to link companies' existing processes with new digital technologies and champions standardised set ups to ensure compatibility of IT systems. It also has programmes designed to support companies wanting to move into the digital arena for the first time, or those wishing to broaden their portfolio of services or specialise in a particular area. The company continues to develop solutions designed to enhance the quality of high-end cut-sheet continuous feed and colour systems.

Amongst others, Xerox produces the DocuPrint Network Printer Series, a family of document production devices for the client-server enterprise network; the DocuTech 6180, one of the most productive digital publishers on the market for print-on-demand applications; and the DocuColor 70, a new digital full colour press offering high quality output suitable for most commercial print jobs.

Said Jerry Luckett, director Xerox Production Systems, Xerox UK: 'We have made significant efforts in recent years to convey the business benefits of digital technology and these results show the message is getting through to the market – companies investing in these solutions will see improvements to their bottom line. The information we have gathered through this research will also help us improve Xerox' services by increasing our understanding of customers' views on digital printing.'

With the total market predicted to exceed 200 000 tonnes by the end of this decade and with over 1000 digital presses installed worldwide – most within the prepress and printing sector – paper manufacturers and their distributors are rethinking their market approach to digital technology. When combined with the emergence of economical office printing machines providing users with the facility to print-on-demand, either through desk top laser, mono or colour photocopiers and inkjet devices, these rapid advances in digital imaging technologies have lead to a worldwide demand for digital printing papers.

Said Derek Jones, Product manager for digital, self adhesive and die cut labels at Brand Paper: 'Digital printing bridges both web, sheetfed and copier technologies and providing the right papers requires an understanding of these differing technologies. Colour photocopiers, inkjet printers, Scitex proofers, Agfa Chromapress and Indigo printing machines will all provide better copies if used with smooth surfaced stocks.

'Papers for the Xeikon, Chromapress and IBM machines have to initially be approved by the press manufacturer after thorough testing on a press. This can often take a great deal of time and once approved, a paper script file is created, published and distributed to enable users to run the paper. For instance, paper grades for Agfa's Chromapress will be awarded category points on a sliding scale between 1A to 4A, and it can take as long as six months for a paper manufacturer to gain an official OEM approval for its products, leaving many mills to ponder the value of breaking into this market.

'Designers and specifiers are used to selecting papers from a broad range available from most leading paper merchants. But, when a paper is required which is intended for digital printing, it is often difficult for the digital printing company to explain to its customer that most designer grades simply will not run through an electrostatic digital press. And that's the story I hear most frequently from customers with a digital press.

'To ensure digital papers run properly they must first be conditioned to the same room temperature of the press room. Moisture, if absorbed, will cause the paper to resist toner or ink adhesion and when printed, may cause the paper to jam in the

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Date .....January.....1998....

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machine. The image may also appear cloudy and mottled because of moisture.

'It's our responsibility, as a leading paper supplier, to educate both digital press users and their customers to exactly what products are available to them. This is what we at Brand Paper have been doing since digital printing began. We are committed to becoming the merchant for digital papers and are well on the way to gaining more than a 20% share of this fast growing sector.'

Océ Printing Systems (UK) Ltd, part of the Netherlands based Océ Group, has launched the DemandStream 3000 DI, its entry level digital cut sheet printer for print-on-demand applications. With a capacity of up to one million pagers per month, the printer is aimed at in-house reprographic departments for the production of technical and other publications, and small commercial printers.

Océ Print on Demand systems consist of three components: the high speed printer, the print server and the finishing equipment. Each configuration is custom assembled and can be easily expanded to accommodate evolving demands. Océ DemandStream digital printers incorporate high speed print engines based on LED technology, and offer 600 dpi resolution, cut sheet or web fed paper processing and print speeds from 55 to 470 pages per minute.

Indigo NV is another leading innovator in digital colour electronic printing systems. The company is engaged in the research, development, production, marketing, distribution and service of electronic printing products. These products include the E-Print 1000+ press for commercial printing; the Omnius One-Shot Colour digital press for label and flexible packaging printing, and the Omnius CardPress for printing on plastic cards: peripherals such as the E-RIP group of off-line image processors, and imaging products incorporating Digital Offset Colour technology including Indigo's ElectroInk products.

During the past two years the digital printing industry has gone through an incubation period. Market awareness has grown dramatically and Indigo's digital printing products have now set new standards for quality and reliability. Consequently, most Indigo customers grew their businesses by over 50% last year alone, and are, today, profitable. Indigo's Easy Entry Programme, offering the E-Print 1000+ at various price levels, now enables a much broader range of customers to have access to these opportunities.

Said Benny Landa, Indigo's founder and chairman: 'Indigo's digital presses are known as the industry's highest quality products. Now they are also the most affordable. When Indigo introduced its E-Print 1000+, it shook the industry with the first digital press to combine the quality of true liquid ink based offset printing with the power of digital printing. As a result, Indigo became the market leader and the E-Print the most widely used digital printing press in the world.'

Indigo also claims to have one of the widest ranges of substrates available for label printing, embracing market leading materials from 3M, Fasson, MACtac, Folex, Jackstadt, Raflatac and many others. Many are ideal for the growing market in durable labels, where substrate differentiation can make the crucial difference in winning highly profitable business.

MoDo Merchants is expanding its range of reels for digital use with the introduction of Silverblade Digital Matt reels in 130 g/m² and DataCopy Digital reels, a smooth white uncoated paper on 100g/m² glazed. Both products are approved by Agfa and Xeikon. Richard Barham, Agfa's business development manager, said: 'We use MoDo DataCopy Option as our benchmark grade. The paper behaves really well on the press, we get wonderful image quality and we can print a superb gloss with our new OmniGloss capability.' In addition, MoDo will add a full range of Silverblade Matt and Art 130-300 g/m² in SRA3 size aimed at the Indigo market. Indigo recommends Silverblade for its presses.

Printers are no longer limited by the conventional printing processes of minimum run lengths and the inability to meet on-demand printing, and because of this,Tullis Russell's Mellotex Digital Reels have been proving very popular for digital colour printing. Mellotex has been trialled by the main manufacturers in the digital printing markets: Xeikon and Agfa Chromapress; both of whom have been delighted with its quality and performance. Indeed, Agfa has awarded Mellotex Digital Reels a first class recommendation.

Alan Harris, product manager for Mellotex, explained: 'Digital printing has revolutionised the print world and is set to grow rapidly over the next couple of years. Mellotex has proved itself yet again to be a first class performer and we are delighted with its success.'

Specialist carbonless manufacturer, Carrs Paper Limited, is currently seeing growing demand for its EP1 range of paper for digital and laser printing. The product was launched following the sales success of Carrs' flagship brand, Signal Plus, which carved a strong hold on the carbonless sheets marketplace with its key features of good runnability and quality finish. EP1 was the first carbonless paper developed for electronic printing. It was pioneered in conjunction with Kodak for print-on-demand, and is now widely used for a variety of office applications.

Carrs' carbonless sales director, John Williams, said: 'EP1 has been developed to offer versatility and ease of use. EP1 is designed to facilitate instant business forms through xerographic and electronic printing, with effortless handling enabling printers to achieve a cost effective result with high standards of finish. We are finding that the product is seeing greatest demand from companies that have a lot of internal paper work. Using EP1 can significantly improve printers' productivity.'

And finally, if all this new technology has got you in a spin, then look no further than Brand Paper's Digi-Helpline (0468 898296). It provides advice on selecting products best-suited to the needs and applications of digital printers. Brand's digital and label guru, Mark Jameson, is standing by with all the answers to your digital dilemmas.

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LDR: Printing Technologies

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Founded in Israel in 1977 as a private research and development company, Indigo provided technology to manufacturing companies. Over the years Indigo conducted a massive research effort to develop high quality, liquid ink, digital printing. In late 1993, armed with their ElectroInk® Technology and a patent fence of more than 100 patents, Indigo introduced its first digital printing press, the Indigo E-Print® 1000™.

To finance its manufacturing and worldwide marketing effort, Indigo N.V. was formed, and in 1994 the company made an initial public offering on NASDAQ. Today Indigo's corporate headquarters, as well as European sales offices, are located in Maastricht, The Netherlands. Research and manufacturing remains in Rehovot, Israel, and the company's North American offices are located in Woburn, Massachusetts.

After more than 75 enhancements were made to the original press, the Indigo E-Print 1000+ was introduced in 1996. Today's flagship product, the E-Print 1000 Turbostream™ was introduced in early 1998. The Omnius®, a press designed specifically for the packaging industry for the printing of labels and flexible packaging, was introduced in 1995, and the Omnius CardPress™ for the manufacture of plastic cards came to market in 1998.

Over the years Indigo has continued to develop and update peripheral equipment, software and consumables for its presses. Indigo made a number of strategic alliances with both technology and substrate companies to permit Indigo press owners to enjoy maximum flexibility and profitability. Indigo has the widest variety of substrates available from 50 lb. text to 12- point cover stock, and specialty substrates from 2 mil to 7 mil.

In 1993 only Indigo could claim the powerful combination of the liquid ink quality level of Digital Offset Color™, a fully digital press, complete personalization and versioning, and the widest array of substrates. Today Indigo, and only Indigo, can make this same claim and remains the world's leading provider of digital press equipment.

LDR is honored and excited to be the exclusive Indigo distributors in the Western United States.

For more information about Indigo or about purchasing Indigo equipment from LDR, contact Dave Gill.

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HP ups the ante in printing-press market

By Stephen Shankland
Staff Writer, CNET News.com
June 7, 2001, 7:25 PM PT

Hewlett-Packard on Thursday began selling a high-end printer model that competes with traditional printing presses as well as laser printers.

The Digital Press 6600 is six and a half feet long, weighs a ton and a half, requires an operator to run it, costs between $200,000 and $400,000, and can print fancy colors such as "rhodamine red." HP hopes the press will carry it into a new market where the company's experience with the Internet will give it an advantage.

The 6600 is intended for print jobs handled today by offset presses--machines that use a decades-old technology to print everything from magazines to soup-can labels. Offset presses are complicated to operate but offer high print quality that's still unmatched by laser or inkjet printers.

The new machine is designed to be easier to use than a traditional offset press, which requires lots of effort--and thus expense--to set up for each new print job, said Ken Cloud, who manages the 6600 product. But the 6600's per-page cost--three to five times higher than offset--means the traditional method is more economical for larger jobs, those requiring 2,500 or more pages, Cloud said.

HP argues that making smaller high-quality print runs easier will make printing custom brochures or high-quality presentations economically feasible. The system could be used to print documents with a different name on each one, for example. HP also expects the machines to get speedier and less expensive.

The company made its foray into the high-end market a day after announcing a push into the low-end printer market. Although the 6600 is a vastly different product than the $49 inkjets HP has begun pushing, one thing remains the same: The company could make money off the ink as well as the printer.

"The supplies business is certainly important for us as we look at how we bring the product to market," said Ed McCarron, director of sales and business development for HP's commercial-printing group.

But profits from the 6600 are certainly not guaranteed. HP has heavy competition for digital presses. German press manufacturer Heidelberg, for example, had sales of $3.5 billion ($5.3 billion euros) in the year ended March 31, with digital-product sales growing about 16 percent to $649 million.

NEWS.COMMENTARY Xerox and a Dutch company called Xeikon also are competitors,

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Gartner analysts Ken Weilerstein and James Lundy say Hewlett-Packard's foray into the high-end, high-speed printing market might leave some questioning the company's commitment.

see commentary

Cloud said.

The segment of the digital-press market on which HP is focused was about $15 billion last year and is growing about 20 percent per year, McCarron said. HP's goals are modest, though; the company aims to have 2 percent to 3 percent of that segment by 2006.

HP believes its presence in Internet services will give it a leg up on its rivals. The company's software can send print jobs to the 6600 over the Internet, for example, and HP foresees a day when its printers can automatically order new supplies over the Web.

Analysts are skittish about HP's overall printer strategy, though. In a report Thursday, Merrill Lynch's Tom Kraemer expressed concern that weakness in today's printer market means HP's printer-supplies revenue could be hit in the future. And some companies may be wincing at printing costs.

Goldman Sachs' Laura Conigliaro warned that General Electric is trying to cut back by removing printers, copiers and fax machines from its offices so employees will communicate electronically instead.

"In doing so, GE expects to reduce maintenance and consumables costs. Although this is only one company's cost-cutting program, we believe it is noteworthy given the company involved," Conigliaro said.

A newer printing technology

The established companies all use laser-printer technology for their products. The 6600 is built using a newer, higher-resolution technology, called liquid electrophotography, developed by another Dutch company called Indigo. HP invested $100 million in Indigo in September with an option for a further $81 million investment.

Indigo already sells high-end printers using liquid electrophotography, Cloud said, meaning HP and Indigo compete as well as cooperate.

Like the technology found in laser printers, liquid electrophotography uses a laser to map out where ink should be placed. But while a laser printer uses dry ink particles that later get fused to the paper, liquid electrophotography uses liquid ink that's transferred to paper with a miniature offset press built into the 6600, Cloud said. The ink has an electric charge and sticks to a drum in the machine that has been given the opposite electric charge by the laser.

The liquid ink particles are approximately 1 micron across, about a tenth the width of a human hair. Current laser-printer toner particles are about four or five times as large, Cloud said. The difference means the 6600 will be able to print much finer detail. And using as many as six different colors of ink means richer color.

Though the system is slower than a traditional offset press, it's faster than a laser printer. It will print color at 34 pages per minute and black and white at 136 pages per minute, Cloud said. It doesn't slow down even when each page is different.

The system can print on both sides of a page as large as 12 inches by 18 inches--from ordinary printer paper to very thick paper, he said. With color ink covering about 60 percent of the page, each page costs between 3.25 cents and 10 cents to print, depending on how many pages total are printed and other factors, Cloud said.

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(54) Paper treatment composition

(57) The suitability of paper for printing by so-called "colour digital presses" of the kind which use a liquid toner or ink is enhanced by the use of a treatment composition comprising an aluminate salt or a salt of a weak acid and a strong base in an amount such as to impart an alkaline surface pH value to the paper. The treatment composition preferably also contains starch or another surface agent, so that the treatment composition also functions as a surface sizing composition.

EP 0 879 917 A2

Printed by Jouve, 75001 PARIS (FR)

Description

This invention relates to the use of a treatment composition for enhancing the suitability of paper for printing by so-called "colour digital presses" of the kind which use a liquid toner or ink.

Colour digital presses were first commercialised on a significant scale around the early 1990's. They are particularly suited to short printing runs for which traditional colour offset printing can be uneconomic and slow because of the high cost and time penalties involved in producing printing plates and setting up the press at the start of the run. By contrast, a colour digital press has no printing plates or comparable set-up costs. It therefore permits a rapid response to print orders ("fast turnaround"), and the cost per impression is not significantly influenced by the total number of impressions being made. These factors make a digital press ideal for short-run colour printing, say for up to about 3000 impressions. Since the information to be printed is stored in electronic form ("digitised"), rather than physically on a printing plate, initial and repeat print-runs can be made "on demand" without the need for physical changes to the press. A further benefit is that variable and non-variable information can be merged between every consecutively printed copy, so that individual impressions within a print run can be personalised or customised so as to be specific to a particular recipient or reader.

Colour digital press technology is based on non-impact printing or imaging technology of the same general kind as is used in plain paper photocopiers and laser printers, i.e. on the use of an electrostatically-charged roll and charged toner particles for image formation. An electrostatically-charged photosensitive roll (the "photoreceptor") is exposed to light in an imagewise configuration such that the surface electrostatic charge on the exposed areas of the photoreceptor is dissipated. Toner is then brought into contact with the photoreceptor, and adheres strongly to it in the unexposed (and thus still electrostatically-charged) areas of its surface, from which it can be transferred to the paper either directly or indirectly via an offset roll.

A single pass through the printing unit provides a monochrome image, but a colour print of a quality comparable to that obtainable by traditional colour offset printing can be achieved either by multiple passes through a printing unit using differently-coloured toners or by a single pass through an array of printing units each of which applies a differently-coloured toner. Typically four passes or printing units are used, three of which apply coloured toners and the other of which applies a black toner. The coloured toners are such that when used individually and in suitable combinations, they can provide a complete spectral range for the finished print, in much the same way as is achieved in conventional colour printing by the use of a black and three differently-coloured inks.

Currently-commercialised colour digital presses can be divided into two groups according to the type of toner used, i.e. whether it is a "dry toner" or a "liquid toner". Dry toners are of a fine particulate nature, with each particle comprising pigment particles bound together in a thermally-fusible polymeric binder matrix. Once the toner has been applied to the paper, heat is used to melt the polymeric binder component of the toner and so "fuse" the toner particles together and to the paper. By contrast, liquid toners comprise toner particles dispersed in a fairly high-boiling organic liquid vehicle, together with dispersed binder particles. During the printing operation, most of the vehicle is thought to be removed and the toner is heated to an elevated temperature (typically 70 - 90°C) sufficient to convert the binder particles to a liquid state. Removal of the vehicle results in an increase in toner viscosity, which facilitates transfer of the toner to the offset roll (if used) and to the paper, with the paper surface absorbing the residual liquid vehicle. The binder reverts to a solid state after the toner has been applied to the paper and so fixes the image (there is no subsequent "fusing" of the toner after its transfer to the paper, such as occurs in dry toner processes).

The paper used with colour digital presses must be carefully chosen if good print quality and runnability through the digital press is to be achieved. Where the press is of the kind using dry toner, the paper requirements are similar to those for plain paper copying and laser printing, primarily a smooth surface, good stiffness, a relatively low moisture content, good dimensional stability under conditions of variable humidity, compatibility with toner so as to permit good toner adhesion and ability to withstand the heat of the toner fusing stage without excessive curling, wavy edge production or blistering. Such papers are readily available at acceptable cost, and so paper availability has not been a significant constraint on market penetration of dry toner colour digital press technology.

The position is rather different in the case of colour digital presses using liquid toners for image formation. Very good results are obtainable with pigment-coated printing papers, but ordinary commercially available uncoated printing and office papers do not give such good results. The main problems are the achievement of good transfer of toner to the paper and subsequent adhesion of toner to the paper. These constraints are serious, since for many applications or end uses the use of uncoated papers is preferred for aesthetic or other reasons.

There is therefore a requirement for a paper which is not conventionally pigment-coated but which nevertheless offers good print performance with liquid toner colour digital presses.

We have now developed a paper treatment composition which, when applied to a suitable base paper substrate, results in significantly enhanced suitability for printing by liquid toner colour digital presses.

In a first aspect therefore, the invention resides in the use, for the purpose of enhancing the printability of paper by means of a liquid toner colour digital press, of a treatment composition comprising an aluminate salt or a salt of a

weak acid and a strong base in an amount such as to impart an alkaline surface pH value to the paper.

In a second aspect, the invention provides a method of printing paper by means of a liquid toner colour digital press, characterised in that the paper being printed has been surface treated with an aluminate salt or a salt of a weak acid and a strong base in an amount such as to give an alkaline surface pH value.

The treatment composition comprising the aluminate salt or the salt of a weak acid and a strong base preferably contains starch or another surface agent, so that the treatment composition also functions as a surface sizing composition. This reduces the cost of the treatment (since no additional paper processing is required beyond the normal size press treatment). It also facilitates uniform application of the active treating ingredient (the salt) across the whole surface of the paper, since the sizing agent functions as an extender. The surface size is typically a starch, but could in principle be a latex, polyvinyl alcohol, gelatin, a cellulose derivative such as carboxymethylcellulose, or other known surface sizing material. Combinations of these materials can be used.

Although size press application is a particularly convenient and therefore preferred method of applying the treatment composition, coating, spraying or other application techniques can be used. Size-presses as referred to in this application include not only traditional size presses but also so-called "metered" size presses of the kind commercialised under the name "Speedsizer" by Voith, "Sym-Sizer" by Valmet, "Twin-HSM" by BTG and "Filmpress" by Jagenberg.

The aluminate salt is preferably sodium aluminate, and the salt of a weak acid and a strong base is preferably sodium hydrogen carbonate (sodium bicarbonate). Less preferred alternatives include disodium tetraborate, trisodium phosphate and sodium acetate. Sodium salts have been referred to because they are the most readily available, but it will be understood that the corresponding potassium salts could equally well be used, as could calcium salts, provided that they are adequately soluble. Sodium aluminate has so far been found to give the best results, possibly because the presence of polyvalent aluminium enhances affinity to toner materials.

Surprisingly, we found that the best results were achieved with a reduced level of starch surface sizing agent compared with that used conventionally in the grades of paper concerned. Thus whereas a starch surface composition typically has a starch concentration of the order of ca. 8%, we found that better results were achieved with a starch surface size concentration of around 2%. Although the pickup of lower concentration surface sizing compositions is normally higher than for more concentrated compositions, the net result is a reduced level of surface size in the paper.

The amount of aluminate salt or salt of a weak acid and a strong base to be used varies in accordance with the type of paper being treated, for example its absorbence and inherent hold-out characteristics and the level and type of internal sizing used. Guidance as to suitable treatment levels is obtainable from the Examples given below. Generally the amount of aluminate or salt of a weak acid and a strong base will be such as to produce an alkaline surface pH value, for example 8 - 8.5 or higher.

Although the present invention seeks to avoid the need for the use of conventionally coated papers with a liquid toner colour digital press, a small amount of pigment (e.g. colloidal precipitated calcium carbonate) can be present in the treatment composition if the effect is not such as to change the fundamental character of the final treated paper, i. e. to convert it from what would be perceived as an "uncoated" grade to a conventional coated product.

The invention will now be illustrated by the following Examples, in which all parts and percentages are by weight unless otherwise specified:

Example 1

A 10% solution was prepared of an oxidised maize starch of the kind conventionally used for surface sizing of paper. This solution was divided into five batches. One of these was used as a control and the others were each made up into treatment compositions according to the invention by the addition of respective salts as listed below:

Salt	Mix Designation
Disodiumtetraborate, $Na_2B_4O_7.10H_2O$	A
Sodium acetate trihydrate, $NaC_2H_3O_2.3H_2O$	B
Trisodium orthophosphate, $Na_3PO_4.12H_2O$	C
Sodium aluminate, $Na_2Al_2O_4$	D
-----	Control

The addition level of the salts was 1% on a dry basis in each case, calculated as weight of dry salt present (as the hydrate form where indicated) in relation to the weight of dry starch present. Starch therefore made up 99% of the treatment composition.

Each treatment composition was airknife-coated on to a smooth wove-finish 100 g m^{-2} business letterhead base paper stock by means of an intermediate-scale pilot coater. This base paper had been internally-sized with alkyl ketene

dimer (i.e. it was neutral/alkaline sized) and had also been conventionally surface-sized. Two different coatweights of treating composition were applied, namely ca. 3 g m^{-2} and ca. 2 g m^{-2} (dry, in both cases). The resulting reels were then sheeted to SRA3 size and test printed on a liquid toner colour digital press (an INDIGO E-PRINT 1000 press supplied by Indigo N.V. of the Netherlands). The extent to which the various samples accepted the ink in a satisfactory manner was assessed visually, and the level of toner adhesion was assessed by "tape pull" and "rub toner adhesion" tests.

In the tape pull test, a length of medium-tack masking tape was applied to the printed area of each sample and then removed. The adhesive surface of the tapes and the areas of the paper from which they had been removed were then examined visually to see how much of the toner had been removed or retained respectively, and the results compared as between the different samples.

In the toner rub adhesion test, printed areas of each sample were rubbed with an ordinary pencil eraser (with the same force and for the same length of time for each sample). The extent to which the print had been dislodged was assessed visually and the results for each sample compared.

It was found that all the test samples gave better ink acceptance and toner adhesion than the control sample. Of the test samples, Mix D (using sodium aluminate) gave significantly better results than Mixes A to C. The lower coatweight samples (2 gm^{-2}) gave better results than the higher (3 g m^{-2}) for all the test samples.

Example 2

This illustrates application of the treatment composition by means of a size press on a full-size papermachine as part of a paper manufacturing operation, rather than in a separate coating operation as in Example 1. The salt used was sodium hydrogen carbonate, $NaHCO_3$.

A batch of 220l of an 8% solution of cationic potato starch was prepared. 3kg sodium hydrogen carbonate were dissolved in this solution with stirring to produce a treating composition of which starch comprised ca. 85%. The resulting composition was fed to the size press of a paper machine producing a 90 g m^{-2} rosin/alum internally sized wove printing paper. The resulting paper was sheeted, printed and tested in the same way as in Example 1.

It was found that the results obtained were comparable to those obtained with sodium aluminate in Example 1.

Example 3

This compares the results obtained with a sodium aluminate treatment composition applied by means of an intermediate scale coater in two different ways, namely by airknife coating and by means of a size press coating head. The treatment composition was prepared as described with reference to Mix D of Example 1 and the dry coatweight applied was ca. 2 g m^{-2} in each case (per side in the case of the size press treated paper). The paper to which the compositions were applied had not been surface sized but was otherwise as in Example 2. After treatment, the paper was sheeted, printed and tested as described in Example 1.

Both treated papers were observed to have better ink acceptance and toner adhesion properties than the control paper from Example 1. Of the two, the size press coated paper was the better, and was judged to be superior to any of the papers evaluated in Examples 1 and 2.

Example 4

This illustrates the use of sodium hydrogen carbonate with a smaller proportion of starch in the treatment composition than in Example 2.

1300 l of a 2% solution of cationic potato starch were made up. 6 kg of sodium hydrogen carbonate were dissolved in this with stirring to produce a treating composition of which the starch comprised ca. 81%. This was applied at the size press of a papermachine producing a 120 g m^{-2} business letterhead wove base paper sized with a proprietary mixture of alkyl ketene dimer and neutral rosin. The resulting paper was sheeted printed and tested as in previous Examples. The ink acceptance and toner adhesion performance was judged to be comparable to that of the sodium aluminate treated paper of Example 1.

Example 5

1300 l of a 2% solution of cationic potato starch were made up. 3 kg of sodium aluminate were dissolved in this with stirring to produce a treating composition of which the starch comprised ca. 90%. This was applied at the size press of a papermachine producing a 100, 120 and 170 g m^{-2} business letterhead wove base papers internally sized as described in Example 4 but with a lower than conventional sizing level. The resulting paper was sheeted, printed and tested as in previous Examples. The ink acceptance and toner adhesion performance was judged to be very good,

and better than that of previous Examples.

Claims

1. The use, for the purpose of enhancing the printability of paper by means of a liquid toner colour digital press, of a treatment composition comprising an aluminate salt or a salt of a weak acid and a strong base in an amount such as to impart an alkaline surface pH value to the paper.

2. The use as claimed in Claim 1, wherein the surface pH value imparted to the paper is at least 8.

3. The use as claimed in Claim 2, wherein the surface pH value imparted to the paper is at least 8.5.

4. The use as claimed in any preceding claim wherein the treatment composition is a surface sizing composition also comprising an aluminate salt or a salt of a weak acid and a strong base.

5. The use as claimed in any preceding claim wherein the surface size comprises a starch.

6. The use as claimed in any preceding claim wherein the surface size comprises a latex, polyvinyl alcohol, gelatin, or a cellulose derivative such as carboxymethylcellulose.

7. The use as claimed in any preceding claim wherein the aluminate salt is sodium aluminate.

8. The use as claimed in Claim 1 wherein the treatment composition comprises sodium aluminate and a cationic starch.

9. The use as claimed in Claim 1 wherein the treatment composition comprises sodium bicarbonate and a cationic starch.

10. A method of printing paper by means of a liquid toner colour digital press, characterised in that the paper being printed has been surface treated with an aluminate salt or a salt of a weak acid and a strong base in an amount such as to give an alkaline surface pH value.